MA 213 — Calculus III Spring 2018
Exam 1 February 8, 2018

Name: ______________________________

Section: ____________________________

Last 4 digits of student ID #: ________

- No books or notes may be used.
- Turn off all your electronic devices and do not wear ear-plugs during the exam.
- You may use a calculator, but not one which has symbolic manipulation capabilities or a QWERTY keyboard.
- Additional blank sheets for scratch work are available upon request.
- All questions are free response questions. Show all your work on the page of the problem. Clearly indicate your answer and the reasoning used to arrive at that answer. Unsupported answers may not receive credit.

Exam Scores

Do not write in the table below

Question	Score	Total
1		10
2		10
3		10
4		10
5		10
6		10
7		10
8		10
9		10
10		10
Total		100

Free Response. Show your work!

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1. (10 points) At what points does the curve $\mathbf{r}(t) = t\mathbf{i} + (4t - t^2)\mathbf{k}$ intersect the paraboloid $z = x^2 + y^2$?

2. (10 points) A curve C is represented by the vector function

$$\mathbf{r}(t) = (\cos t)\mathbf{i} + 3t\mathbf{j} + 2\sin(2t)\mathbf{k}.$$

Find the unit tangent vector to C at the point where $t = 0$.

3. (10 points) Evaluate the limit

$$\lim_{t\to 0}\left(e^t\,\mathbf{i}+\left(\frac{\sin 2t}{t}\right)\mathbf{j}+(\tan t)\mathbf{k}\right).$$

4. (10 points) Identify the surface $9y^2 - 4z^2 = x^2 + 36$ as one of the following types:

a. Cylinder

b. Ellipsoid

c. Elliptic Paraboloid

d. Hyperbolic Paraboloid

e. Cone

f. Hyperboloid of One Sheet

g. Hyperboloid of Two Sheets

Free Response. Show your work!

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5. (10 points) Which of the following four planes are parallel? Are any of them identical?

$$P_1 : 3x + 6y - 3z = 6 \qquad P_2 : \; 4x - 12y + 8z = 5$$
$$P_3 : 9y = 1 + 3x + 6z \qquad P_4 : \; z = x + 2y - 2$$

6. (10 points) Determine whether the lines L_1 and L_2 intersect, and if they do, find the point of intersection.

$$L_1 : \quad x = -1 + 3t, \qquad y = 3 - t, \qquad z = -3 + 2t$$
$$L_2 : \quad x = -3 - 5s, \qquad y = 4 + 2s, \qquad z = -4 - 3s.$$

Free Response. Show your work!

7. (10 points) Find an equation for the plane through the points $(0, 1, 2), (1, 0, 2)$, and $(1, 2, 0)$. Write the equation of the plane in the form $2x + by + z = d$.

8. (10 points) Find the volume of the parallelepiped with adjacent edges PQ, PR, and PS, where

$$P = (-2, 1, 0), \quad Q = (2, 3, 2), \quad R = (1, 4, -1), \quad S = (3, 6, 1).$$

Free Response. Show your work!

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9. (10 points) Find the acute angle between the lines $3x - y = 7$ and $2x + y = 3$. [An exact answer in radians is expected. Approximate answers will nor receive full credit.]

10. (10 points) Find the work done by a force $\mathbf{F} = 8\mathbf{i} - 6\mathbf{j} + 9\mathbf{k}$ that moves an object from the point $(0, 10, 8)$ to the point $(6, 12, 20)$. The distance is measured in meters and the force in newtons.